Slow light - opportunity for photonic crystals ?

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There has been much excitement in recent years over the ability to slow down light, with opportunities for the realisation of optical delay lines and memories. The pioneers exploited the phenomenon of electromagnetically induced transparency in atomic systems, e.g. bringing light almost to a standstill in ultracold atoms. More recently, EIT slow light has also been reported in solid state systems. In contrast, slowdown factors in photonic crystals are much lower (typical values of c/100 to c/1000 [1] are being reported), yet photonic crystals offer a key advantage: Bandwidth. Using the bandwidth x slowdown factor as a figure of merit, photonic crystals offer clear advantages over EIT systems. Furthermore, using their well-known scaling capability, they can be tuned to any wavelength of interest and due to their dielectric nature, their response is entirely linear. Different photonic crystal-based concepts for slow light generation and their practical realisation will be discussed.

[1] H.Gersen, T.J. Karle et al., “Real-space observation of ultraslow light in photonic crystal waveguides”, PRL 94, 073903, 2005.